

Acids and alkalis part 1

3.1—Acids & alkalis in solution

All acids form **hydrogen (H^+)** ions in solution.

All alkalis form **hydroxide (OH^-)** ions in solution.

3.2—pH values

All acids have a pH value of **below 7**.

All alkalis have a pH value of **above 7**.

Neutral substances have a pH value of **7**.

3.3—Indicators

Indicator	Colour in acid	Colour in alkali
Phenol-phthalein	Colourless	Pink
Methyl orange	Red	Yellow
Litmus	Red	Blue

3.4—ions & pH (HT only)

The pH of an acidic substance decreases as the concentration of H^+ ions **increases**.

The pH of an alkaline substance increases as the concentration of OH^- ions **increases**.

3.5—pH and H^+ ions (HT only)

As the pH value of a solution increases by 1, the H^+ ion concentration **decreases** by a factor of 10.

As pH **decreases** by 1, the H^+ ion concentration **increases** by a factor of 10.

If a solution of pH 2 is diluted by a factor of 1000, the new pH is **5**.

3.7—concentrated and dilute (HT only)

A concentrated solution contains lots of the **solute** dissolved in the **solvent**.

A dilute solution contains little of the **solute** dissolved in the **solvent**.

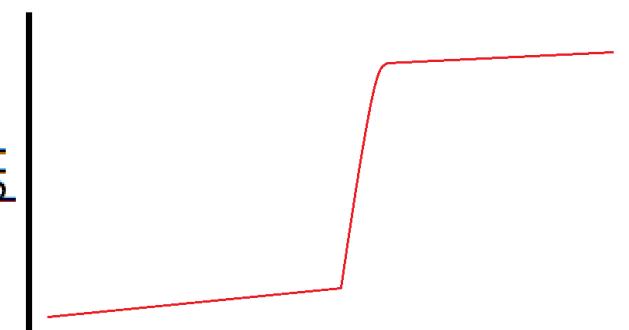
You can dilute a solution by **adding water (or removing some solute particles)**.

3.6—CP 2—investigating the effect of powdered $Ca(OH)_2$, on pH

Sketch a graph (right) showing how the pH changes when $Ca(OH)_2$ is added to an acid.

Describe the safety precautions you have to take in this practical (the acid is irritant, and the calcium hydroxide corrosive to the eyes).

Wear safety glasses to protect eyes.
Wash skin if it comes into contact.



pH
Mass of $Ca(OH)_2$ added

Explain why using a pH meter/probe to measure the pH is preferable to universal indicator.

pH meter gives a more precise reading, and a numerical value, rather than a colour.

3.8—strong & weak (HT only)

A strong acid/alkali **fully** dissociates (splits up to form ions) when dissolved in water.

A weak acid/alkali only **partially** dissociates (splits up to form ions) when dissolved in water.

This means that a strong acid would have a **lower** pH value than a weak acid of equal concentration.

3.9—Bases

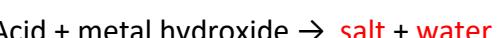
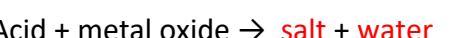
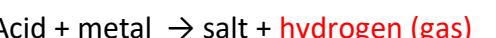
A base is a substance which **neutralises** an acid to produce **water** and a **salt** only.

3.10—Alkalies

An alkali is a **soluble** base.

3.11—Reactions of acids

Complete the general formulae



3.12—Testing for gases

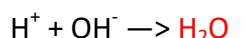
The positive test for hydrogen is **hold a lit splint to the gas; squeaky pop**.

The positive test for carbon dioxide is **limewater turning cloudy**.

3.13—Neutralisation reactions: in words

A neutralisation reaction is one in which **an acid** and a base react to form salt + water only.

3.14—Neutralisation reactions: in ions



Common acids & alkalis

Name	Formula	Salt formed by acid	Name	Formula
Hydrochloric acid	HCl	Chloride	Sodium hydroxide	NaOH
Sulfuric acid	H_2SO_4	sulfate	Potassium hydroxide	KOH
Nitric acid	HNO_3	Nitrate	Lithium hydroxide	LiOH

3.15—Soluble salt from an insoluble reactant

3.15a—Adding a excess of the insoluble reactant

Explain why we add an excess of insoluble solid in this type of reaction.

To ensure all of the acid reacts.

3.15b—Removing the unreacted excess

Name the separating technique we use to remove the unreacted solid, and explain why this step is necessary.

Filtration

To remove the unreacted base and ensure a pure product.

3.15c—Salt & water solution

Explain why only the salt and water are left in the solution, and name the separating technique we use to collect a sample of salt crystals.

All of the unreacted solid has been removed & the acid is fully reacted; we use crystallisation.

3.16—Soluble salt from a soluble reactant (e.g. alkali)

3.16a—Titration

Explain why we must use titration, referring to what would happen if we added an excess of one of the reactants.

We must use titration to work out the correct amount of acid to add. All of the chemicals are colourless solutions, so we can't tell when the reaction is complete.

3.16b—The volume of each reactant

Explain why it is important to know the **exact** volumes of the two reactants that are reacted together.

To ensure that the product is pure.

3.16c—Salt & water solution

Explain why only the salt and water are left in the solution, and name the separating technique we use to collect a sample of salt crystals.

We have exactly neutralised the acid & alkali; crystallisation.